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ABSTRACT

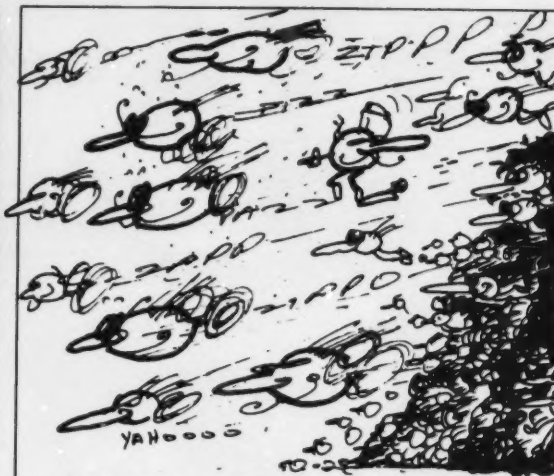
This product of Scotland's Film Workshop Trust provides information on a range of topics pertaining to taking, developing, and printing of pictures. The manual includes units on the working principles of the camera, developing and printing materials in a darkroom, and designing and setting up a personal darkroom. Also included are some ideas on how to use photography in project work and to publicize local activities and needs. (MEE)

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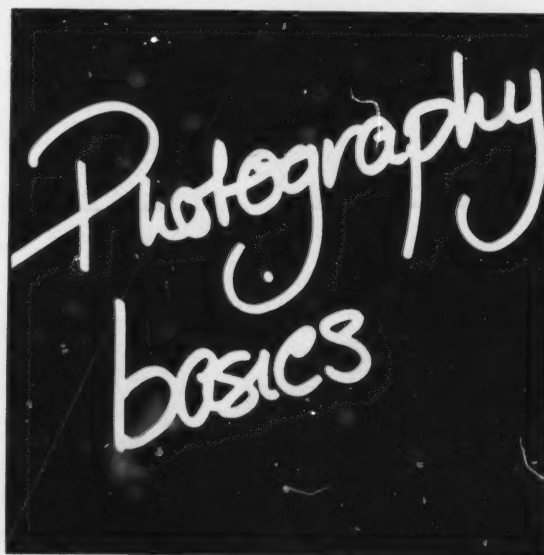
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A flash-bulb will emit a million billion photons per second!



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Photography does not necessarily mean using expensive cameras and complicated equipment in the darkroom.

This leaflet explains how to take pictures, develop and print them yourself, cheaply and easily.

Also included are some ideas on how you can use photography in project work and to publicise local activities/needs.

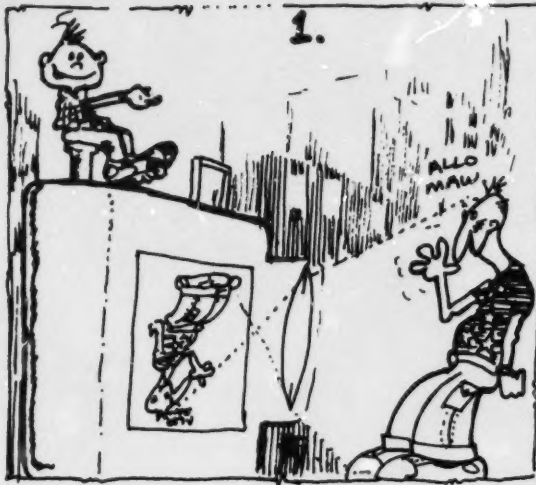


Making a contact sheet in the darkroom

Contents

1. The camera, working principles.
2. Developing and printing in the darkroom.
3. Setting up your own darkroom.
4. Uses of photography in the community and some examples of photographic projects.
5. Carrying out a project and making a cheap exhibition.

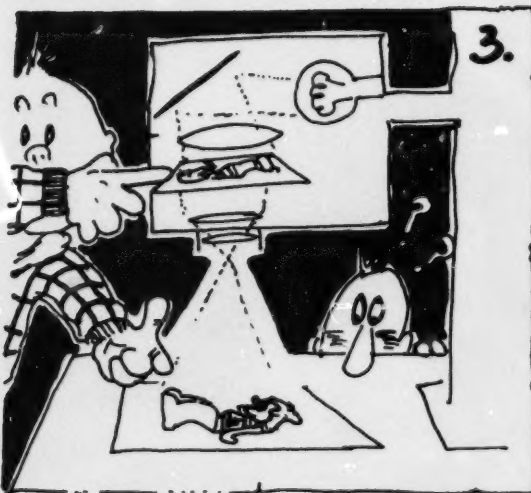
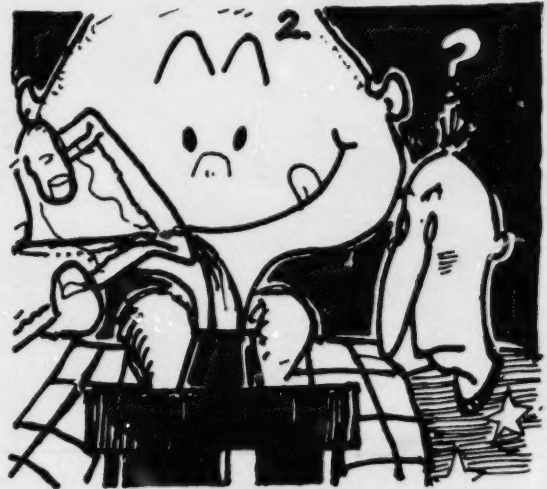
The camera: working principle



The steps in taking a photograph are the following:

1. Letting light fall onto light-sensitive material — the film — to record an image.

2. Processing the film to make the image visible and permanent.



3. Using this image, which is called the negative, to make a positive image on paper — the print.

Step 1 involves the use of the camera.

Step 2 and 3 means working in the darkroom.

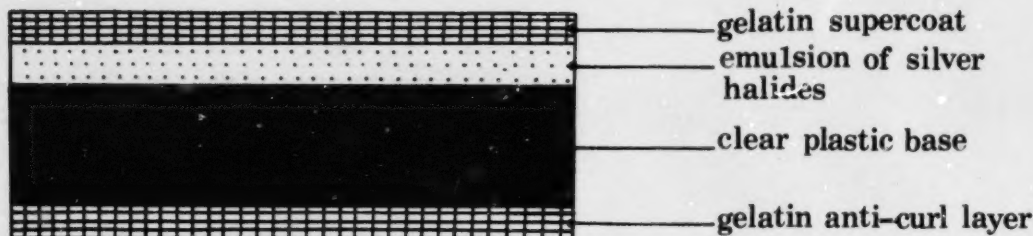
The Camera

Any type of camera, however complicated, or whatever price, works on the same basic principles. Each is a box with a piece of film on one end and a hole to let light in at the other end.

A camera can be made from an old biscuit tin; alternatively a highly refined and sophisticated one can cost thousands. Whatever kind of camera you use, the film is the actual material used to record a photographic image. The controls on your camera allow you to vary the amount of light falling on the film.

The Film

CROSS SECTION OF FILM



The diagram shows a cross section of black and white film magnified many times. Light entering the camera lens and striking the film surface will convert some of the silver halides to black metallic silver. The more light that comes through the lens, the more silver is formed and the film will be more 'exposed'.

The purpose of working in the darkroom is to treat the film so that this process is amplified by millions of times — this is called the 'development' of the film. The more light-struck areas will be recorded in black tones and the less light struck areas in lighter tones. The tones of the image will appear to be reversed. This is the negative.

To make a positive print from photographic paper we place the negative in an enlarger or contact printer. Whichever you use the object is the same: to shine light through the negative and expose the image onto photographic paper. The darker tones on the negative will allow less light through the lighter tones; so after this exposure to light, the photographic paper will record the image the right way round, in positive tones.



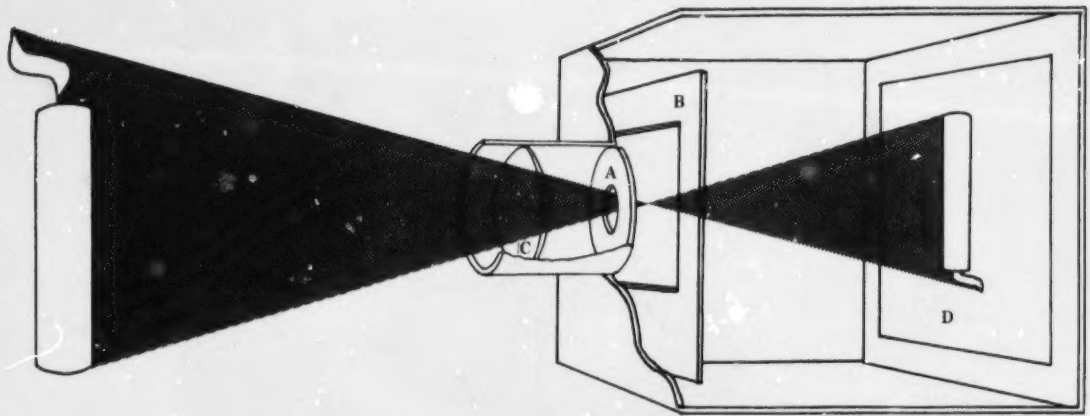
image recorded in negative tones



image recorded in positive tones

Photographic paper works in the same way as film. A paper base is coated with an emulsion of silver halides which is converted to black metallic silver when struck by light.

The Camera



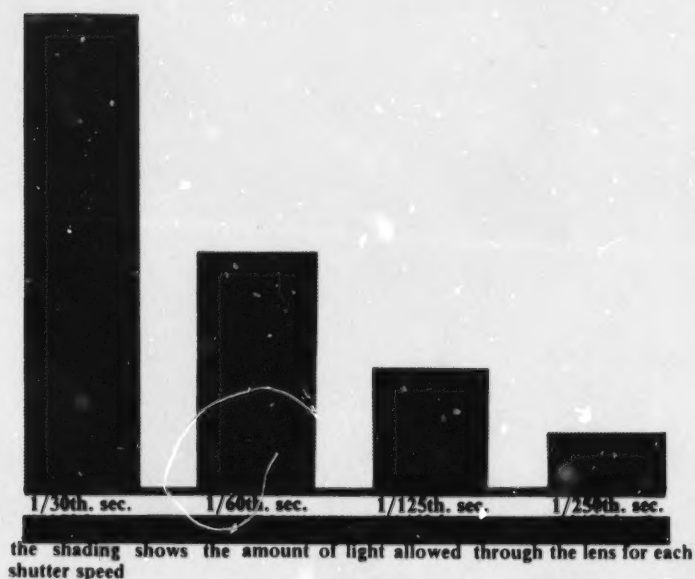
THE BASIC PARTS OF THE CAMERA

Most cameras have these basic features—

- A. The diaphragm which forms an adjustable hole or 'aperture' so that the amount of light entering the lens can be made more or less.
- B. The shutter, which controls the flow of light by the amount of time it remains open. There are two principal types of shutter, the leaf and focal-plane shutter. Their action may be different but the effect is the same, to control the amount of light entering through the camera lens.
- C. The lens which focuses light rays from the subject onto the film.
- D. The film, which records the light. Notice how the image is recorded upside down and back to front.



The Shutter Speed Control



Using the controls on the camera

The two most important controls and which prove the most difficult to understand are the shutter speed and aperture settings. These two together control the amount of light reaching the film.

Shutter speeds are measured in fractions of seconds, e.g. 1/30, 1/60, 1/125th. of a second. Each shutter speed allows twice as much light to fall on the film as the shutter speed above it. For example: 1/60th. allows twice as much light as 1/125th. of a second and half as much light as 1/30th. of a second.

The aperture is measured in 'stops', called 'f' stops. The lower the f number the wider the aperture and the more light is let in. All apertures are marked in standard numbers, for

The Aperture Control



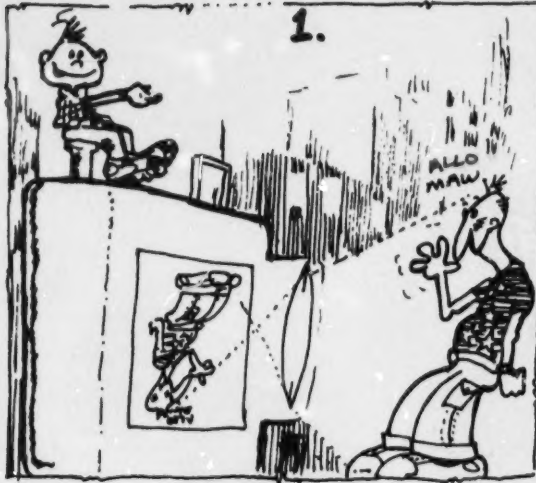
f markings on camera lens

instance f16, f11, f8, f5.6. As for the shutter control, each aperture setting allows twice as much light to fall on the film as the aperture setting above it.

As a very rough guide, the controls are used together to allow a similar amount of light to fall on the film, despite variations in the light conditions.



The camera: working principle

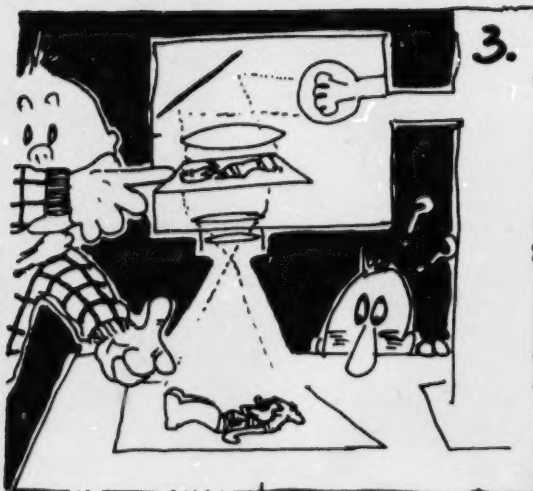
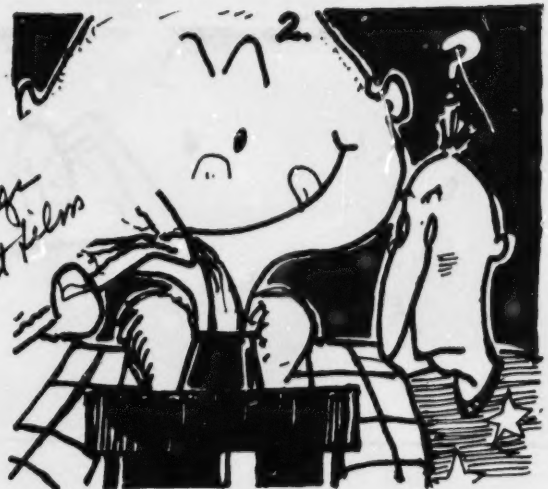


The steps in taking a photograph are the following:

1. Letting light fall onto light-sensitive material — the film — to record an image.

2. Processing the film to make it visible and permanent.

*Blank page
do not film*



3. Using this image, which is called the negative, to make a positive image on paper — the print.

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The Camera

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*Blank page
do not film*

Printing and developing in the darkroom

When light enters through the camera lens and strikes the film it does not make any visible change, at least to the naked eye. What the light does is to form 'potential action spots' where it strikes the film.

When processing your film in the darkroom these action spots are the chemical key to the developer — the first stage in processing. The developer centres onto the spots to convert the silver halide into black metallic silver.

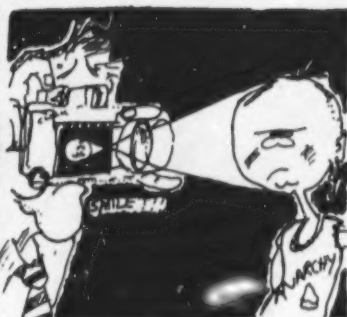
How film works: making an image in silver.



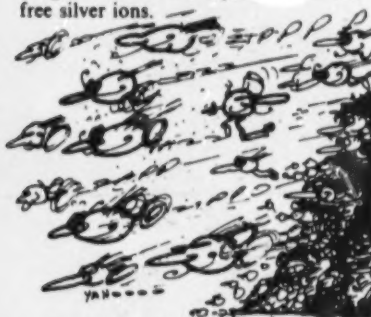
The emulsion of a film contains light-sensitive crystals of silver bromide. Also present are impurity spots, slight irregularities in the crystal and a few free silver ions.



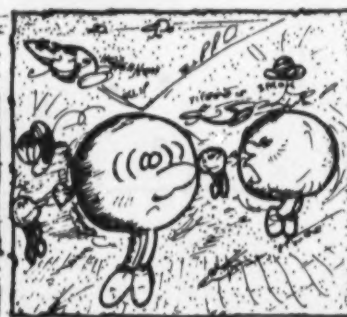
Most of the silver ions and all the bromide ions are held together in a lattice by electrical attraction.



When the shutter is released, a stream of light photons are allowed through the lens to strike the film.



A flash-bulb will emit a million billion photons per second!



These photons give energy to the bromide ions, releasing electrons.



These electrons will drift until they reach an impurity spot.



The impurity, now with an extra electron, will attract free silver ions towards it. This tiny speck constitutes the latent image, an invisible chemical site.



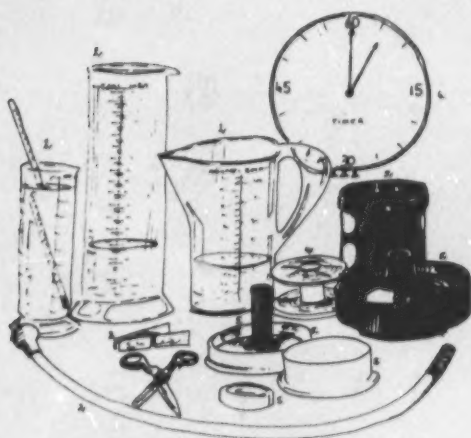
During processing, these sites will act as the chemical key to the developer, attracting all the silver ions in the crystal to clump together, forming visible black metallic silver.



THE END

Developing your film what you need

1. Measuring jug and thermometer.
2. Hose for washing the film.
3. Pegs or clips to hang the film to dry.
4. Spiral.
5. Developing tank.
6. Second timer.



Chemicals in the darkroom

Making negatives:

1. Film developer: this should be matched to the film being used. In any darkroom used by a number of people doing different projects it helps to try and standardise. At Film Work-hop we use Kodak Tri-X as our standard black and white film for 35mm work and Verichrome pan film 126 size for work with children and teenagers at the beginner stage. We use a Kodak developer, D-76, to process both these film types. This saves having dozens of bottles with half-used solutions going stale, although the main advantage is in learning to estimate slightly different development times for different effects as experience builds up.

The main rival black and white film to Tri-X is Ilford's HP5. If that is chosen as the standard, it would make sense to use an Ilford developer, Microphen, as the standard film developer in the darkroom. For slow films, fine grain developers are manufactured but fast films have been improved to such an extent that they have become the all-purpose black and white films. Kodak and Ilford Microphen are both powder developers and can be bought in packs to make 2.5 or 5 litres. Powder developers are more economical than liquid developers because you do not pay for water being packaged.

If anything, D-76 has a slight edge on Microphen for the reason that D-76 is a one-shot developer, being thrown away after use, while Microphen is returned to the bottle. As the developer becomes exhausted through being used, the development time becomes less and less certain and a careful count must be kept on the label of the number of films processed. In a darkroom used by a number of people, inevitably this is neglected.

The instructions with the developer should be kept and pinned up for constant reference, or better still, copied out on a card for wall display.

Stop-bath

Only a very small amount of stop-bath is needed in the rinse following development of your film. Kodak make a litre bottle which should last at least a year.

Fixer

This chemical hardens the film emulsion and converts any undeveloped halides into clear colourless salts, so that the film can be seen and used under any light conditions.

Rapid fixers are more convenient (but more expensive) than the old-fashioned kind in the community darkroom. For comparison, total fix time in rapid fixer is 90 seconds, while normal fixer takes 10 minutes. Where there is a pressure on time available to users, or simply to save hanging around, rapid fixer is an obvious choice.



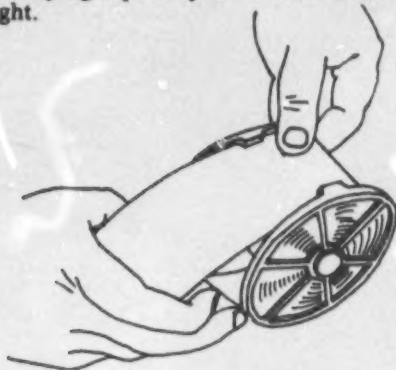
Stages in the development of your film

There are three stages, the development; the rinsing with 'stop-bath' to halt development, and the fixing.

1. Prepare all your solutions beforehand: developer, stop-bath and fixer. Make up the solutions according to each manufacturer's instructions. Each 35mm film will need 10 fluid ounces to cover it. Keep all the solutions around 68 degrees F/20 degrees C. The timing and temperature during development are critical.

2. Practise loading film onto the spiral with a dud one in daylight, then again with your eyes closed, because you will be doing the real one in complete darkness.

3. In complete darkness, break open the film cassette and cut off the end of the film so that the edge is straight. Feed the film into the spiral. Rotate backwards and forwards and peel off the remaining spool. Place the spiral inside the tank body, secure the lid. As the tank is completely light proof you can now switch on the light.



loading the film into the spiral

4. Read off the temperature of the developer. If it is at all above or below 68 degrees F/20° C read off from the chart supplied with the maker's instructions the time needed at the given temperature. When using a standard developer it is useful to pin this chart up on the wall. As a very rough guide, because chemical reactions are speeded by heat, the higher the temperature is above 68° F/20° C the less time is needed for development.

5. Pour in the developer quickly, start the timer and agitate either by turning upside down or roll the tank for five seconds. After agitation tap the tank to release any air bubbles. At each minute repeat the agitation.

6. When the required time is up, pour away the developer either back into a storage bottle or down the sink depending on whether it can be used again or not. Pour in the stop-bath immediately to halt the development and shake the tank for about a minute. When using this solution for films it is best to throw away the solution after use as after a time it will collect dust.

7. Pour in the fixer and agitate for the first five seconds and again for five seconds at each minute. The total time for fixing is usually between 2-3 minutes depending on the make and concentration of the fixer. This can be poured back into a bottle for storage and used again, until it has been exhausted.

To test that your fixer can be used again, cut off a small strip of undeveloped film and put in the fix. It should be cleared in half the time recommended on the maker's instructions.

8. Wash your film by fitting a hose onto a cold tap and running water in the tank for half an hour.

9. Hang your film in a dust-free atmosphere to dry. When completely dry, cut into strips and store in negative files. The film surface can be easily scratched and collects dust very readily. For this reason try not to leave your processed film hanging about for longer than necessary.

Printing

Paper. There are two main paper manufacturers, Ilford and Kodak. There is little difference between the two either in quality or price. Paper comes in different grades from zero to five. Grade two is the most used for the 'average' negative. Grades zero and one soften the image, while grades three to five harden it and give more contrast.

A paper recently introduced called Ilfospeed Multigrade can be made into any grade by using filters which fit into the enlarger. The advantage is that you do not have to buy several different boxes of grades. The main disadvantage is that these filters are delicate and can be easily scratched. In a darkroom used by a number of people it also means that the filters can be muddled.

Most paper now in use is resin coated. This means that it is virtually waterproof and therefore permits rapid washing and drying. The older type of paper, bromide paper, is not resin coated and so not advisable for use in a community darkroom because of the long times required for drying and washing. This paper also curls when dried. As well as different grades, paper can be bought with different surface finishes. For publication purposes, a glossy surface is preferred.

Paper developer

The main manufacturers are May and Baker (Suprol developer); Ilford (Ilfospeed); and Kodak (Universol and D.163 developer).

As with the film developer it is good to standardise and use one type of developer. All these makes can be bought as liquid concentrates in five-litre plastic cans. It does not matter if your paper is of a different make than your developer.

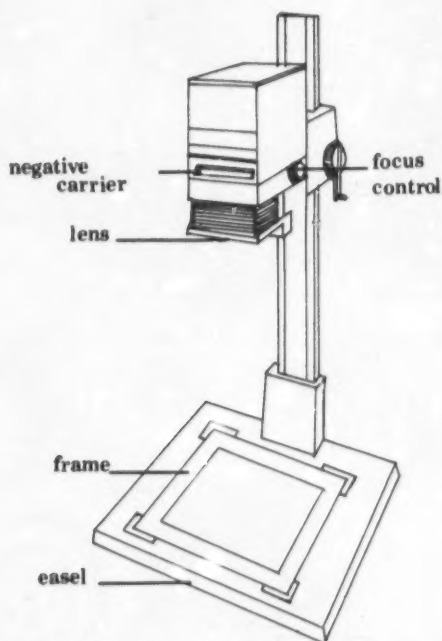
Paper fixer

The main makes are Kodafix, Ilfospeed and Amfix. All can be bought in five-litre cans as liquid concentrates. Fixer can be used again over a period of time although you should test regularly for exhaustion with the film test. The instructions with the fixer will give its fixing time and the film should clear in half this time.

Printing, the steps involved

Printing means making a positive image from your negative onto photographic paper. Making a print follows the same process as for making a negative. Instead of a camera we use an enlarger, or sometimes with large format negatives a contact printer.

The enlarger consists of a light source, a condenser which is a lens to form an even beam of light, a drawer for your negative and a lens with aperture settings.



THE ENLARGER

Light shining through your negative will strike the paper to form a positive image. Since the darker tones on the negative will allow less light through than the lighter tones, the image formed on the paper will be reversed to record a positive.

As with the film in your camera, light shining through your negative in the enlarger will, where it strikes the film, form 'action spots'. These spots, acting as the chemical key for the developer, will form black metallic silver. This process works on exactly the same principles as does light action on your film.

Since photographic paper is not sensitive to red light this whole process can be done under red safe-light conditions. Because making a print follows the same principles as making a negative, the same steps are involved. After exposure the paper is processed in developer, stop-bath and fixing. This time it is done in trays under red safe-light conditions.

Making a contact sheet

Before starting on your print it is a good idea to make a contact of all the negatives on your film. This will give you an idea of what each print will look like and is especially useful to keep beside the sheet of negatives in your file, so that anyone can quickly and easily identify any negative in the darkroom.



Arrange your negatives cut into strips of six onto a piece of 10 by 8-inch size paper. Place the paper so that the emulsion side of the negatives (non-glossy side) is in contact with the glossy side of the paper. Over the two, place a sheet of glass to keep the negatives and paper touching, and place under the enlarger. An average time for contacting film onto paper is 10 seconds with the lens set at f8. If your negatives are especially dark, give more time; if they are especially light, give less time.

Switch on the enlarger and expose the paper for the time you want. Now develop, stop and fix as for any print. See below for how you do this. A contact printer made for this purpose can be bought and is worth the cost as it saves having sheets of glass lying around and is less likely to scratch your negatives. It also makes it much easier to position the negatives.

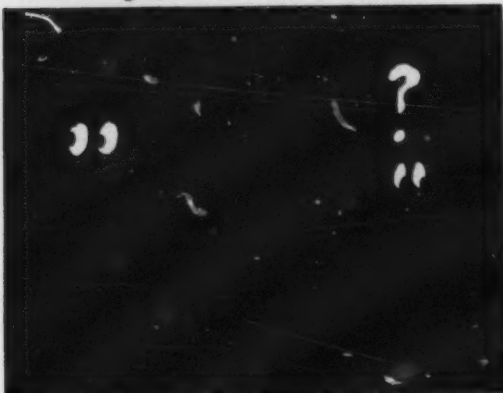
Setting up a darkroom

Almost any room can be made into a darkroom — cupboards, bathrooms, kitchens are all easily convertible.

There are three essentials for setting up a darkroom—

1. Running water, hot is not essential but it makes work easier, as long as there is hot water available somewhere in the building.
2. Ventilation.
3. Complete blackout.

To test whether the room is blacked out enough, switch off all the lights and stay in the room until your eyes are used to the darkness. After a minute or so, if you cannot see any cracks of light, the blackout is sufficient.



Any black or dark coloured cloth will do to block out stray light. For the door it is best to have some kind of permanent light blocker like rubber strips around the door. This helps with a lot of people coming in and out.

What you will need

Chemicals and paper have already been discussed in the 'Developing and Printing' section. Below is a list of what else you will need.

Many of these items can be found second-hand or even hand-made. It is worth hunting around different camera shops to get the best price, putting adverts in the paper and reading the 'For Sale' section in photo magazines.

Developing tank

For a darkroom used by lots of people, it is best to get one tank for single films and a multi-unit tank which can hold up to eight spirals. The multi-unit tank saves a lot of time when developing several films at the same time. Paterson tanks are the best and the most common ones on the market.

Measuring cylinders

You can make do with one, although for a darkroom used by a number of people at least three are good to have. Fairly large ones are best, to hold up to 40 fluid ounces.

Thermometer

This is essential in any darkroom. Buy one especially made for photography as this will give you accurate readings on the right scale.

Enlarger

Durst make very good reliable ones. The latest 'small ones' are the Durst C35 or M302. This is for 35mm use only. The enlarger will come without a lens. A good quality lens is recommended such as Rokkor or an El Nikkor (size 50mm). For work in different formats the Durst 605 is good but pricey.

Enlarger board

You can buy special easels to hold your paper under the enlarger, however these can be considered as unnecessary expense. We found at Film Workshop that unless we were making very large photographs, cut-out window frames to the size of the paper are a lot easier to work with. A cheap easel supplied with magnetic corners can be bought at most photographic dealers to keep the frame in position.

Focus finder

This is not essential but makes focusing your pictures more accurate when the negatives are too dense to focus easily with your eyes.

Trays

Most darkrooms have two sets of trays, one for average-sized prints (10" x 8" or 12" x 10"), and one for the biggest size of print anyone is likely to make.

Darkroom lights

Kodak Beehive lamps have several advantages—they can be mounted on the wall or free-standing. Filters can be changed for different needs of different photosensitive materials. One for print inspection and a couple for overall illumination provide a comfortable working environment.

If different filters are not needed, the ordinary Paterson safe-light is good and a lot cheaper.

Chemicals

If you are buying chemicals in five-litre quantities you will need some spare plastic cans to make up any solution which comes in powder form, for instance D-76 developer.

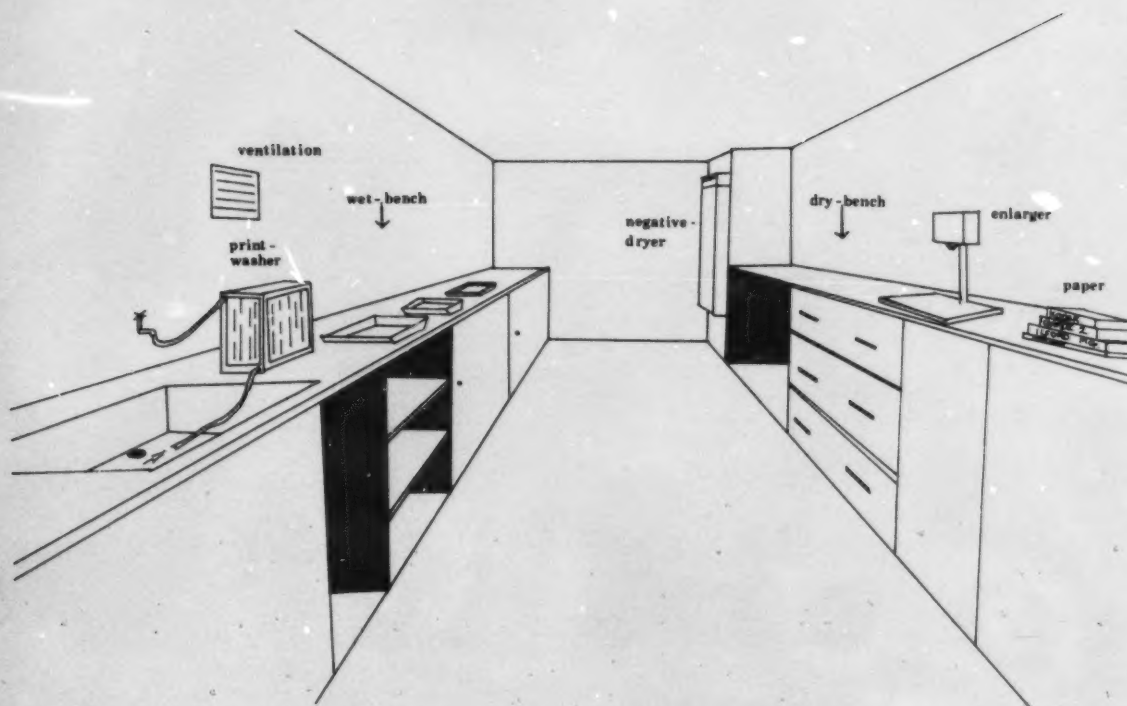
Stop-bath and fixer you may want to keep made up between sessions in the darkroom as they do not need to be thrown away each time. Spare cans or bottles should always be kept labelled and stoppered.

Film

You do not have to buy your film in shops as you can roll your own. Photographic dealers sell bulk film, usually in 30-metre lengths. At the time of writing rolling your own film costs two-thirds less than ready-rolled film. As well as bulk film stock you will need masking tape to attach to film to a reel and empty canisters.

Layout of the darkroom

For a darkroom to be used by a number of people, the more space the better. Two long benches running down each side are ideal. The one nearest the water supply should be kept for wet work, the other for dry work only. This is important as water and solutions can easily be spilled and damage your negatives.



When planning your darkroom, make sure that there is plenty of storage space with cupboards and shelves for keeping negative files, films, solutions, paper etc. If possible, both the benches should be kept clear for printing and processing.

All bottles should be labelled — this seems obvious but it often happens when one or two people are using the darkroom more than the others that storage becomes 'personalised'. The darkroom should be organised in such a way that a number of different people can use it.

Uses of photography in the community

The national papers and television offer little opportunity for people to present their own opinions and productions.

Photography at the local level can be used to provide important channels of communication around community action. Many things can be highlighted including festivals, youth club activities, new arts projects; as well as focusing attention on environmental and social needs.

Alternative photo-journalism is distributed through exhibitions, meetings and conferences. It can also be geared to provide relevant teaching material originated within communities themselves.

All that is needed are the basic resources; photographic equipment, a darkroom and a simple training programme to provide access and arrange projects with groups of all ages.



Some examples of projects run by Film Workshop Trust

1. This summer Film Workshop worked with a group of children from Pilton, a post-war housing scheme in the North of Edinburgh. Many of these children had had little experience of anything outside the concrete and boredom of their immediate environment. As part of the project, trips were organised to natural areas outside the city.

Each child had access to an instamatic camera and they took pictures of the trips and of their families and friends at home. Sessions were organised in the darkroom where they learnt how to develop and print.

Slides taken by project workers and slides made from the prints were used with tape collected from the trips to make up a slide/tape show for a conference on children's play facilities.



2. Documenting work on arts therapy with the mentally and physically handicapped. Exhibitions and slide shows on therapy can develop a valuable resource for therapists wishing to communicate their work and experience. A co-production between therapist and photographer means that each stage of the production can be planned and monitored jointly. At the same time photographic skills may be passed on to the therapist.



3. Developing a training programme so that photographic skills are passed on to youth and community workers. As well as writing this leaflet, this involves arranging the bookings for the darkroom so that access is made and keeping chemicals and paper well stocked up.



4. 'Young Eyes' project. Young Eyes is an international exhibition of young people's photographs, with prints from communities in Kentucky, Labrador, New Brunswick, Chicago, Puerto Rico, London, Arran and Edinburgh. At the time of writing Young Eyes is on a Scottish tour. The exhibition acts as a focus for community interest by incorporating local children's work into a body of work created by children living in many parts of the world.

As part of the tour photographic workshops are run in each centre and prints arising from the work are fed into the exhibition. The workshops are the key element in Young Eyes — since it is here that young people and youth leaders can pick up skills and ideas from which further projects can be invented.



boy on stairs by Carmen Santos from Puerto Rico.

Carrying out a project and making a cheap exhibition

Planning your project

It is well worth while to spend time planning a project. Write down its aims and processes involved to help keep things in perspective. Flo-diagrams and a budget estimate are useful. So much will develop during a project that it is easy to spend time and money on unnecessary activities.

Carrying a project out

It is best to work with small groups of about four-five in the darkroom. Obviously this will depend on the number of project workers and the size of your darkroom. Remember, children will get bored if a lot of time is spent hanging around. Try and keep the groups the same, it will be more interesting for you and the groups involved.

Making a cheap exhibition

An exhibition can be made cheaply without too much trouble preparing it. At Film Workshop we start off with an already white bordered print and mount straight onto pieces of black card. The cheapest method is to glue. Spray glue especially made for photographs can be bought at most photographic dealers.

Distribution

Photographs do not have to be displayed in special galleries, usually situated in the centre of towns. Any wall space will do; shops, community centres, launderettes and pubs can all be made into exhibition spaces.



Other techniques in photography

Photography is not only confined to making the standard print. Slide shows, multiple images, montage, photograms, painting with fix are all examples of what can be done with photography.

One simple technique which we found especially useful at Film Workshop is to make photograms. This is a good illustration of how light works on photographic paper, cheaply and easily, as no film or camera is needed.

Place any object which blocks out light onto a piece of photographic paper and switch on the light or expose under the enlarger for about 10 seconds. Develop, wash and fix as for any normal print. In the summer we use leaves collected from outdoor trips which can also help children identify different types of leaves.